Hydrologic Model Manager

Short Name	Large Basin Runoff Model
Long Name	
Description	
Model Type	Tank Cascade
Model Objectives	Use over large areas where only daily precipitation and air temperature data are available.
Agency_Office	USDOC, NOAA, Great Lakes Environmental Research Laboratory
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Model Structure	The model is designed as a lumped-parameter description of a watershed. Moisture storage tanks, representing upper and lower soil zones, a groundwater zone, and a surface none, are described with mass continuity equations and united with concepts of linear reservoirs, degree- day snowmelt and snow balance, complementary evapotranspiration and evapotranspiration opportunity, and partial-area infiltration and runoff. The resulting set of first-order linear partial differential equations are analytically tractable; the solution at each time step (day) depends on daily tank inputs and model parameters.
Interception	
Groundwater	
Snowmelt	
Precipitation	
Evapo-transpiration	
Infiltration	
Model Paramters	An index air temperature for scaling total heat available for evapotranspiration during the day as a function of air temperature (Tb), a proportionality constant for snowmelt per degree-day (a), linear reservoir coefficients for percolation (ap), interflow (ai), deep percolation (ad), groundwater flow (ag), surface outflow (as), and partial linear reservoir coefficients for upper soil zone evapotranspiration (bu) and lower soil zone evapotranspiration (bl).
Spatial Scale	Designed for watersheds between about 120-20000 km2
Temporal Scale	Designed for the daily time interval, both for data input and internal calculations.
Input Requirements	Required are daily precipitation, daily minimum and maximum air temperatures, a standard climatological summary of daily extraterrestrial solar radiation, and, for comparison purposes (calibration), daily basin outflows. Also required is the area of the watershed. About one meteorological station per 70 km2 has been found adequate when combined into lumped daily meteorological data series through Thiessen weighting. Also required are initial conditions for all of the model moisture storages: snowpack (P), upper soil zone (U), lower soil zone (L), groundwater zone (G), and surface zone (S).
Computer Requirements	Modest; IBM-compatible personal computers (PCs) are adequate with 4MB memory and 10MB disk space or better.
Model Output	As provided, primary outputs are: end-of-day moisture storages in the snowpack, upper soil zone, lower soil zone, groundwater zone, and surface zone, as well as the daily outflow volume from the watershed. In addition, secondary outputs are readily available with only minor program modification for all of the internal daily flowrates, including snowmelt, direct runoff, infiltration, percolation, evapotranspiration, deep percolation, interflow, and

	groundwater.
Parameter Estimatn Model Calibrtn	The LSRM has been calibrated for each Great Lakes watershed with 30 years of daily weighted watershed climatologic data. The nine parameters are determined by searching the parameter space systematically, minimizing the root mean square error between model and actual outflows for each parameter, selected in rotation, until all parameters converge within two or three significant digits. This procedure is implemented in FORTRAN 95 for (IBM compatible) personal computers, suitable for use under either MSDOS or Windows (95, 98, NT, or 2000). The software, available on the book's CD, can also be modified to maximize sample correlation between actual and model daily flow volumes.
Model Testing Verification	The LBRM, calibrated to 1965-82 data, was used in forecasts of Lake Superior water levels and comparisons with climatic outlooks showed the model was very close to actual runoff (monthly correlations of water supply were on the order of 0.99) for the period August 1982 - December 1984 which is outside of and wetter than that calibration period. The model also was used to simulate flows for the time period 1956-63, outside of the period of calibration, for all of the Great Lakes. The correlations of monthly flow volumes between the model and observed during this verification period are a little lower than the calibration correlations but quite good except for Lakes Superior and Huron (there were less than two thirds as many flow gages available for 1956-63 as for the calibration period for these basins).
Model Sensitivity	See: Croley, T. E., 11, and H. C. Hartmann, 1983. Lake Ontario basin runoff modeling. NOAA Technical Memorandum ERL GLERL-43, National Technical Information Service, Springfield, Va. 22161, 108 pp. Croley, T. E., 11, and H. C. Hartmann, 1984. Lake Superior basin runoff modeling. NOAA Technical Memorandum ERL GLERL-50, National Technical Information Service, Springfield.
Model Reliabiity	Studies on the Lake Ontario Basin show that the simple search algorithm does not give unique optimums for calibrated parameter sets because of synergistic relationships between parameters. However, the calibration procedure does show a high degree of repeatability for recalibrations with different starting values, and consistent parameter values are obtained for watersheds with similar hydrologic characteristics. This is especially so when considering the interpretations attached to parameter sets, rather than the parameter values themselves. For example, very small groundwater storage can be represented either by a very small deep percolation linear reservoir coefficient or by a very large groundwater linear reservoir coefficient.
Model Application	The LBRM has been calibrated for each of the 121 individual Great Lakes contributing riverine watersheds, for each of the 7 large Great Lake basins (in a "lumped-parameter'approach), for each of the 7 individual Lake Champlain contributing riverine watersheds, for the single Lake Champlain basin (in a "lumped-parameter'approach), and for the Embe, Ural, and Volga river basins.
Documentation	
Other Comments	
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